



EX PARTE OR LATE FILED

Northern Telecom Inc. Tel. (202) 347-4610

801 Pennsylvania Avenue, N.W.
Suite 700
Washington, DC 20004

DOCKET FILE COPY ORIGINAL

March 7, 1994

RECEIVED

MAR - 9 1994

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Mr. William Caton
Acting Secretary
Federal Communications Commission
Room 222
1919 M Street, NW
Washington, DC 20554

Re: Ex Parte Presentation GEN Docket No. 90-314
RM-7140, RM-7175, RM-7618

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules, you are hereby notified that David Steer, Manager, Wireless Communications Systems, Ihor Nakonecznyj, Senior Product Line Manager, and the undersigned, all of Northern Telecom, met with Julius Knapp, Chief, Authorization and Evaluation Division, David L. Means, Chief of the Engineering Evaluation Branch and Phil Inglis, Electronic Engineer on March 7, 1994, and discussed issues relating to unlicensed PCS in the referenced proceeding.

The discussions are summarized in the attachment to this notification. The attachment was also provided to the FCC staff with whom we met.

Sincerely,

Raymond L. Strassburger
Director, Government Relations - Telecommunications Policy

RLS/gj
Attachment

cc: Julius Knapp
David Means
Phil Inglis

No. of Copies rec'd
List ABCDE

0

RECEIVED

MAR - 9 1994

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY



**Docket 90-314 Second Report and Order
Unlicensed PCS**

Isochronous Sub-band

(1) Channel Access and Operation

- (a) operation of multi-carrier devices
- (b) duplex channels

(2) Physical Limits

- (a) acknowledgement time limits
- (b) channel packing in frequency and time
- (c) protection of unlicensed operation from licensed emissions
- (d) temperature range
- (e) power measurements

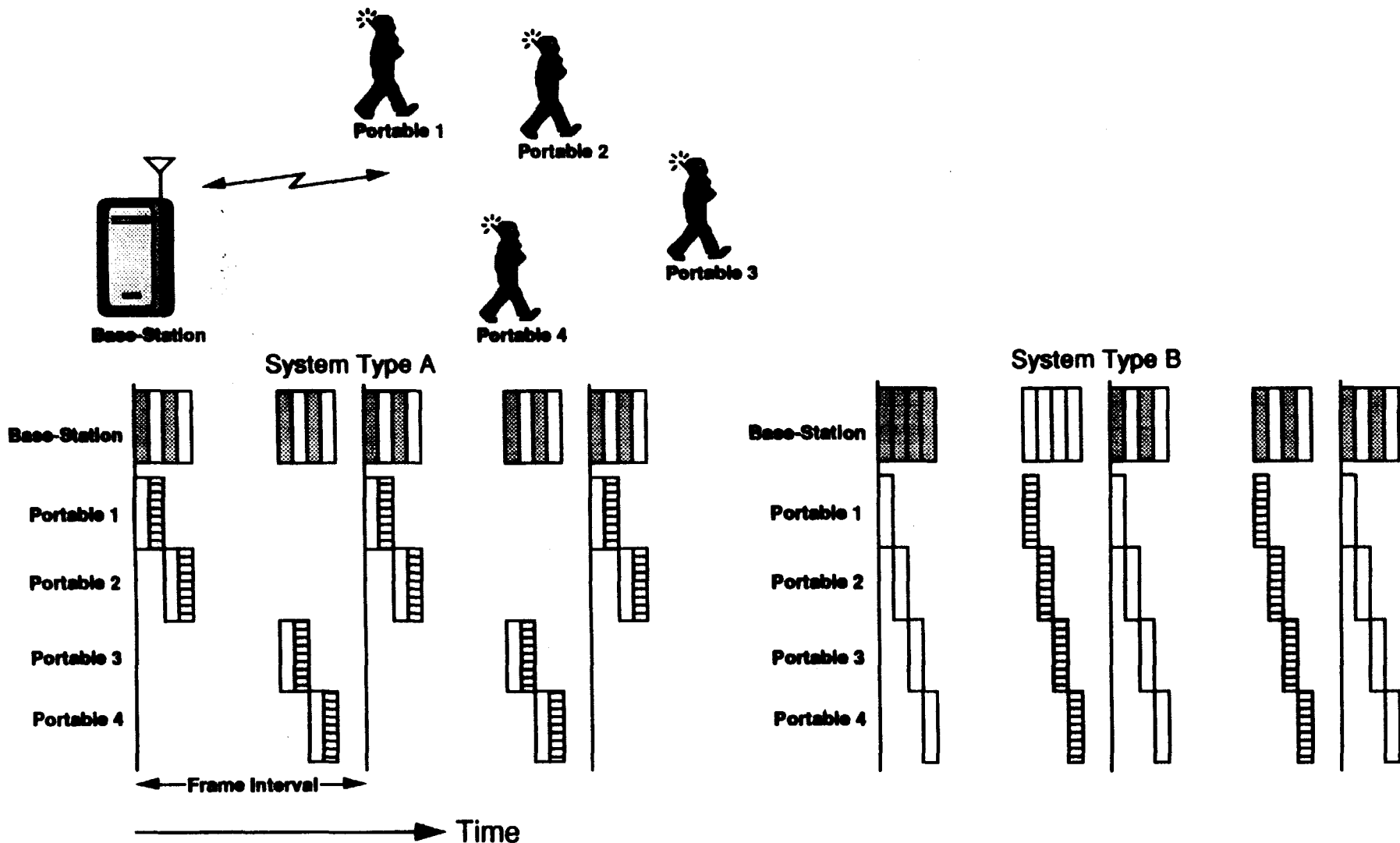
March 7, 1994

5084

- **Regular, repetitive transmissions**
 - **conversation between two devices**
 - **conversation duration of minutes, maybe hours**
 - **Time Division Duplex (TDD)**
 - **Time Division Multiple Access (TDMA)**
 - **Dynamic Channel Allocation (DCA)**
-
- **single device (base station) may handle several (many) calls**
 - **single device (portable) may handle only a single call**
 - **typically several base stations cooperate to cover a service area**
 - **signalling (marker) transmissions required for for UTAM coordination**
 - **must accommodate coexistence of devices from same system and between different systems**

Operation - TDMA / TDD

Isynchronous Sub-band
Comments



Reciprocal transmit and receive time slots defined for duplex operation. May be different for different systems.

Dynamic Channel Allocation

Isosynchronous Sub-band
Comments

Devices capable of
accessing all
channels
(time/spectrum
windows) as needed
to serve traffic and to
adapt to the RF
propagation, usage
and interference
conditions

Example System Channel Plan

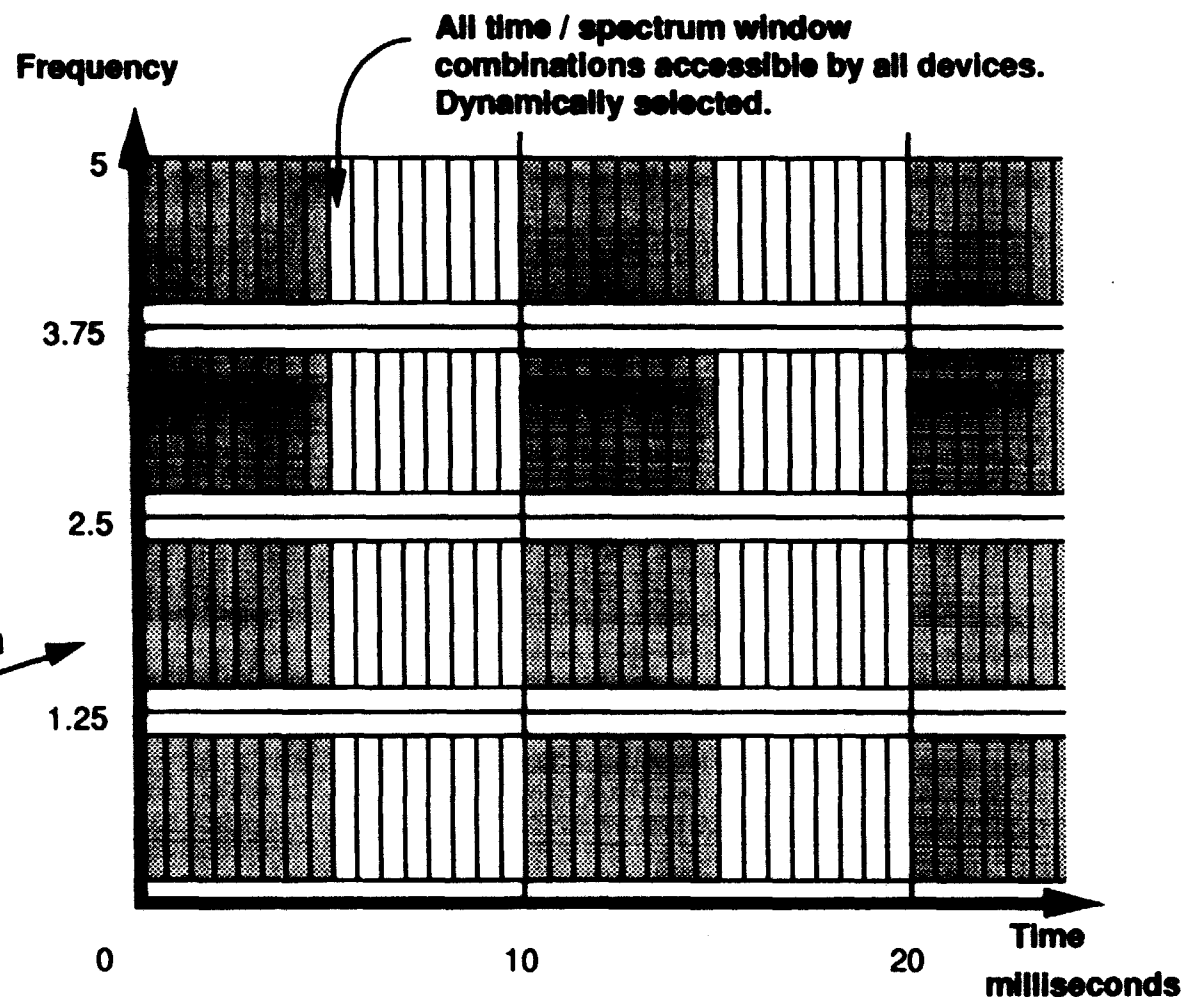
10 millisecond frame

8 duplex time slots/frame

8 carriers at 1.25 MHz spacing

1 MHz emission bandwidth

(64 duplex channels total)



"Etiquette" Rules :

15.303 (d) Isochronous Devices

15.321 (a) (frequency) Channels

15.321 (e) Frame Period (10/X milliseconds)

Timing Stability (10 ppm)

15.321 (f) Frequency Stability (10 ppm)

15.321 (c) Listen-Before-Transmit

15.321 (c)(1) Monitor Interval (10 milliseconds)

15.321 (c)(7) Monitor BW, reaction time ($50\sqrt{1.25/BW}$ μ sec)

15.321 (c)(2) & (5) Monitor Thresholds

15.319 (c) Transmitter Power ($100\sqrt{BW}$ μ Watts)

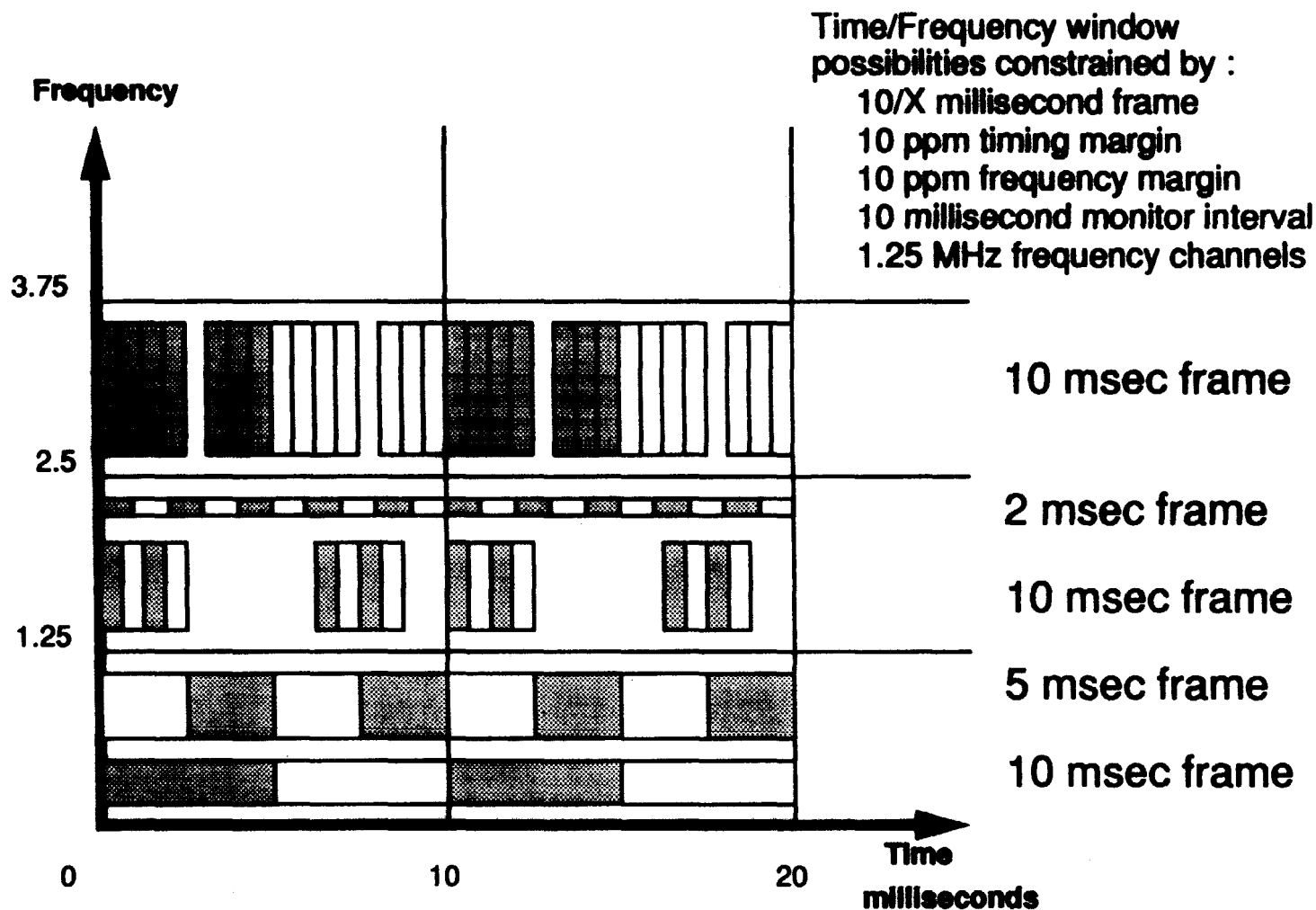
15.321 (c)(4) acknowledgement within 1 second

15.321 (c)(8) 8 hour limit

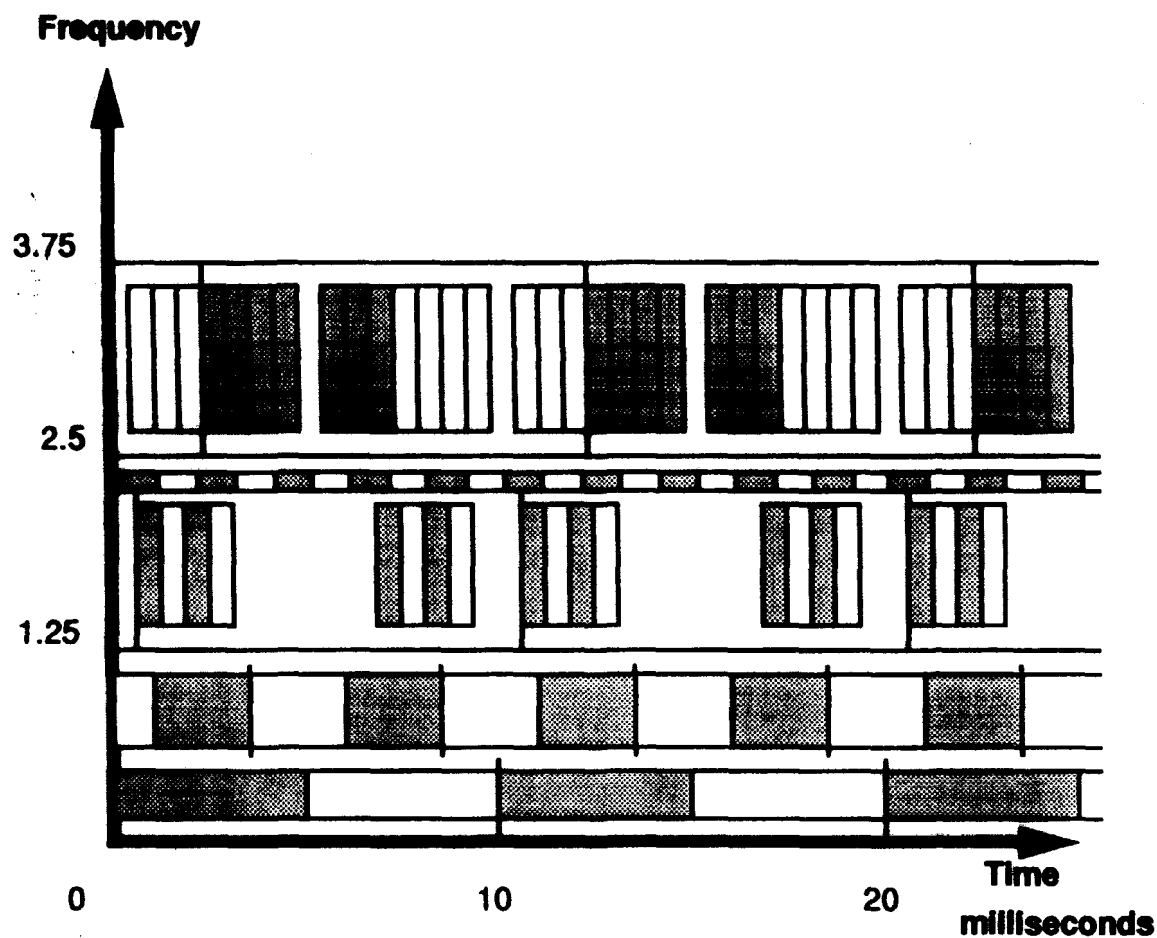
together, these rules define an environment of time and spectrum

Coexistence

Isochronous Sub-band
Comments



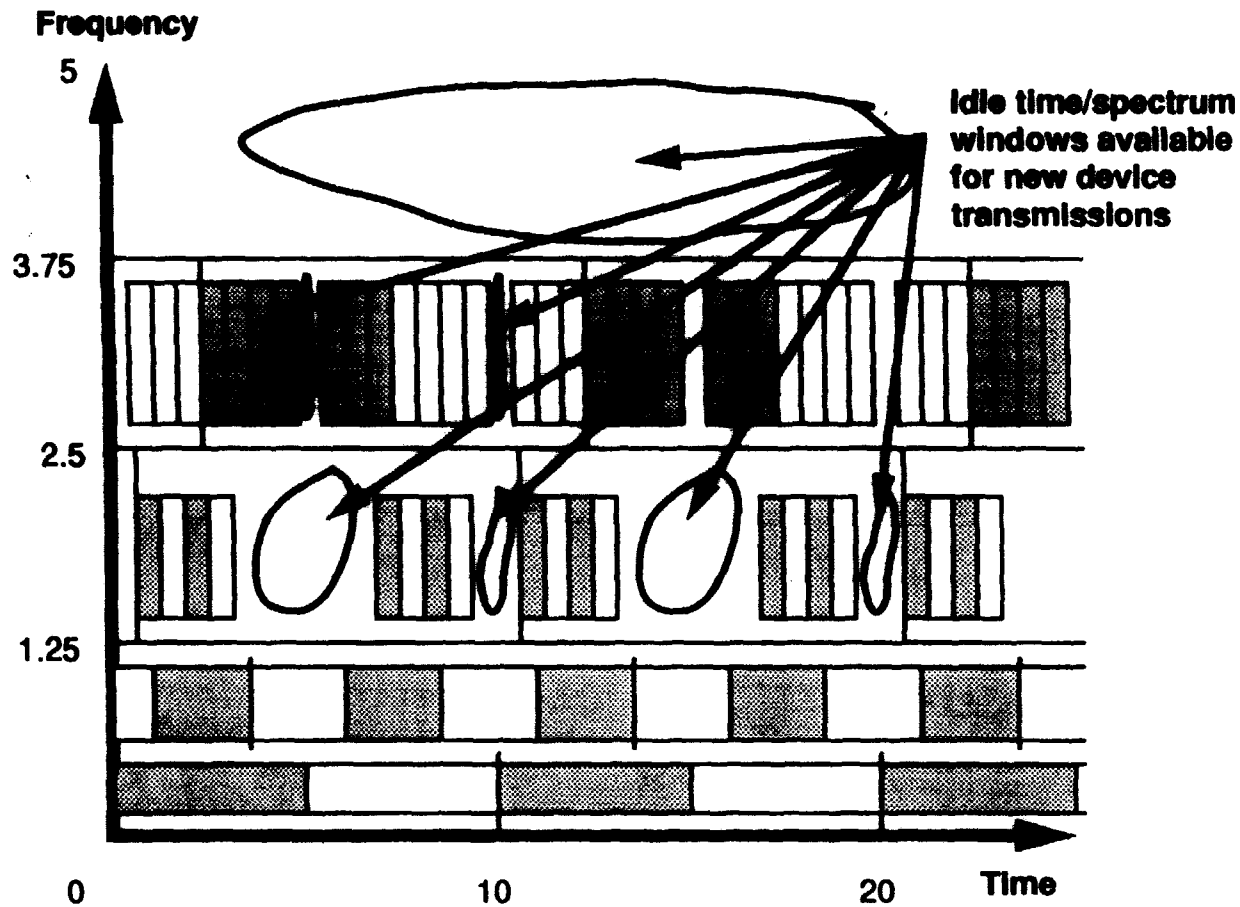
A wide variety of different systems may coexist within the isochronous sub-band



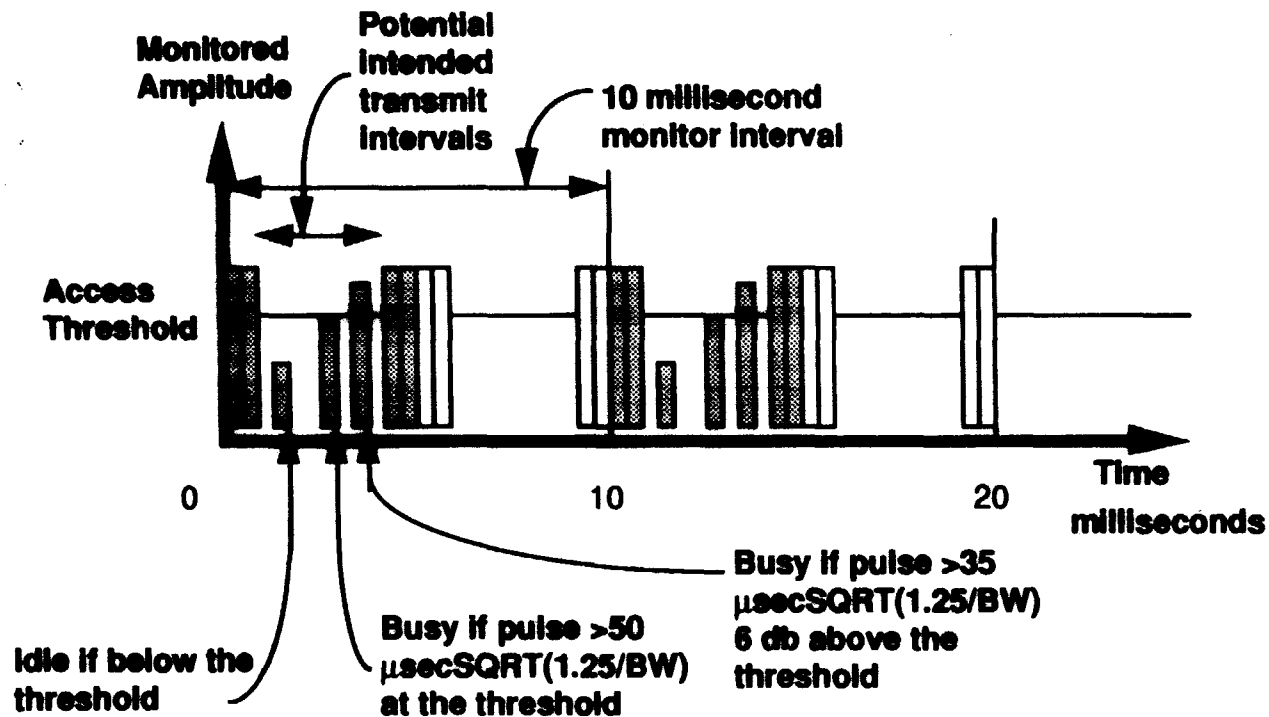
Random alignment of frames between different systems.
Frame alignment will drift over time due to timing margins (10 ppm).

Idle Time / Spectrum Windows

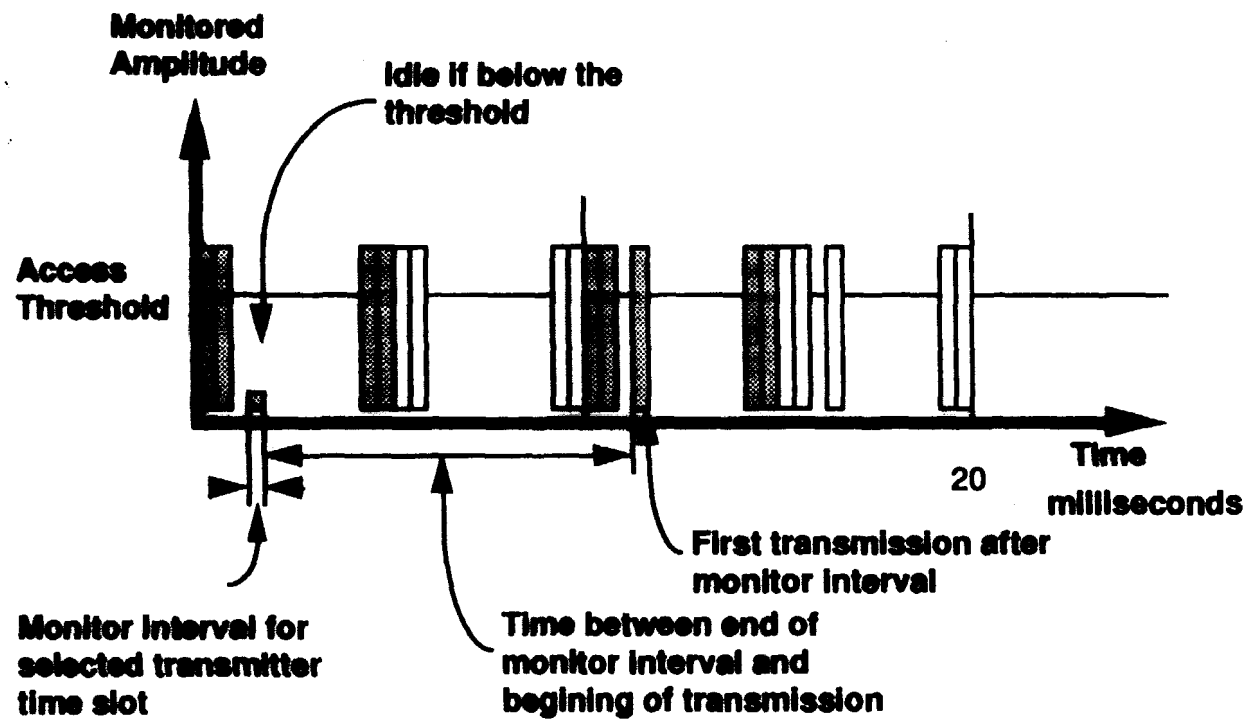
Isynchronous Sub-band
Comments



idle time/spectrum windows may be found by listening during the intended transmit interval



10/X millisecond frame period quantization means that a 10 millisecond monitor interval will include an integral number of other system's frames

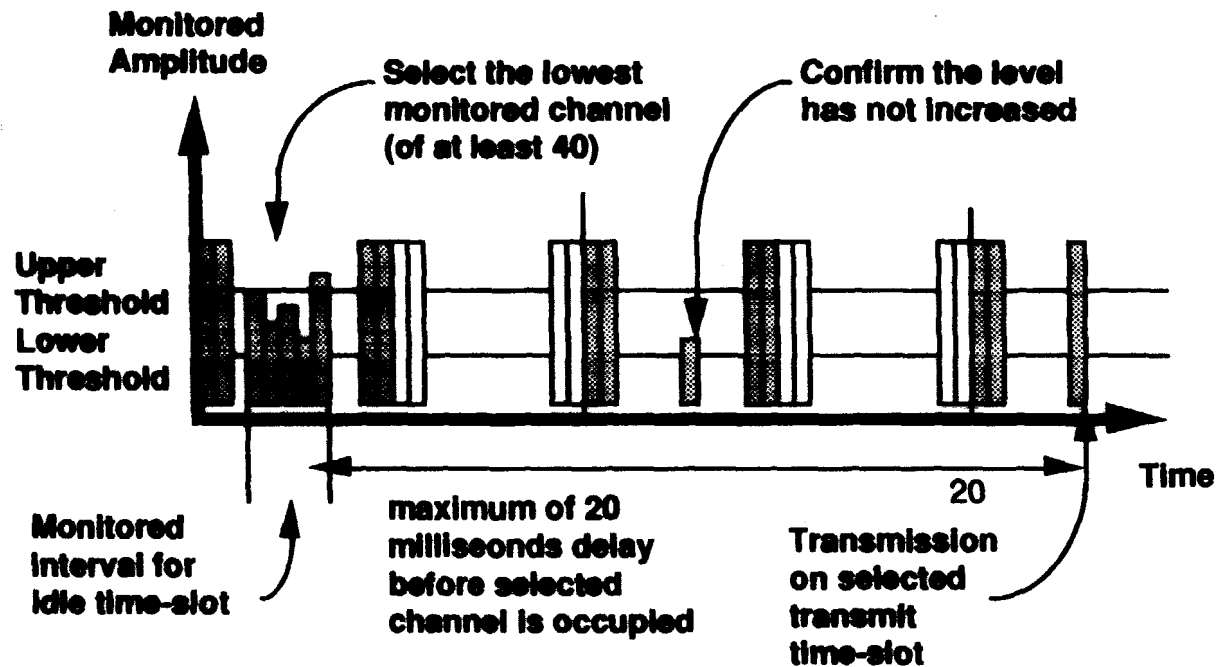


Note that the Rx-Tx "turn around" time is inherent in the frame period

Access Interval

Isochronous Sub-band
Comments

monitor
rule 15.321 (c) (5)
(upper and lower access thresholds)



When monitoring many time/spectrum windows and using the upper threshold provision, the transmission on the selected time/spectrum window must begin within 20 milliseconds of the monitor operation indicating the time/spectrum windows is free.

Multi Carrier Operation

Device (base station) may handle more than one call at a time. The traffic capacity of the device is limited by the number of time slot (windows) available in the frame period. When the number of calls exceeds the number of time slots, the device must access additional frequency channels.

The requirement to monitor during the transmit interval means that when selecting an additional frequency channel, the device will hear mainly its own transmissions * (due to its currently active transmitters) and this will prevent the selection of additional frequency channels.

- WINTech provided a multi carrier access provision for this situation

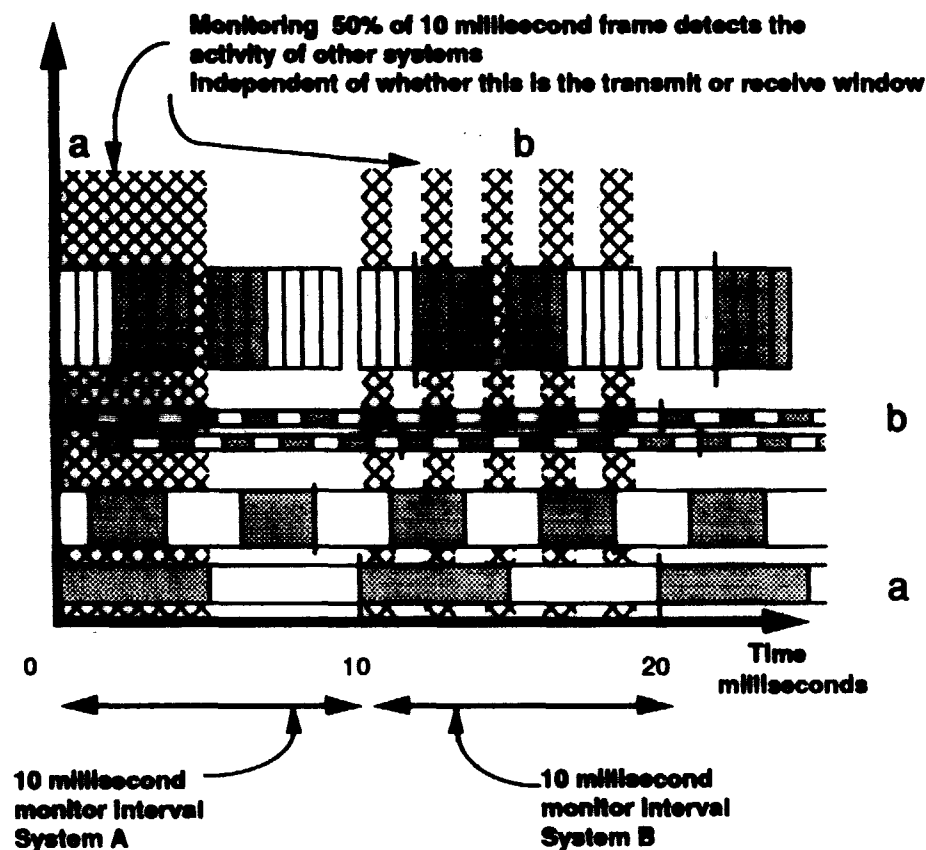
under this rule, a device that is blocked from monitoring during its transmit interval is allowed to monitor during its receive windows if these total at least 50% of the 10 millisecond monitor interval and the frequency window is confined to the 1.25 MHz frequency channel(s) already occupied

* for example with a +20 dBm transmitter power, 10 dB of isolation between transmitter and receiver and 70 dB of channel filtering, the receiver would expect to see -60 dBm as its monitored level which is well above the allowed access threshold of -84 dBm. An additional frequency channel could never be selected.

Monitoring is performed in order to detect the presence of another user of a time/spectrum window. The probability of detecting the other transmissions depends on the overlap between the monitor interval and the interval the other transmitter is active. This is independent of the relation between the monitoring system's transmit and receive intervals.

The monitor interval can be either the transmit or receive window without reducing probability of detection.

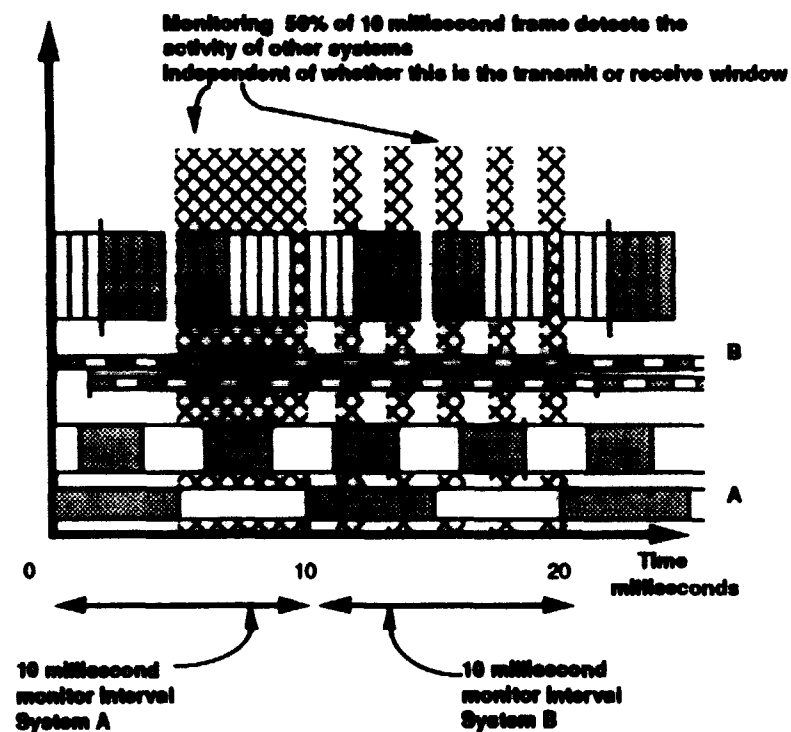
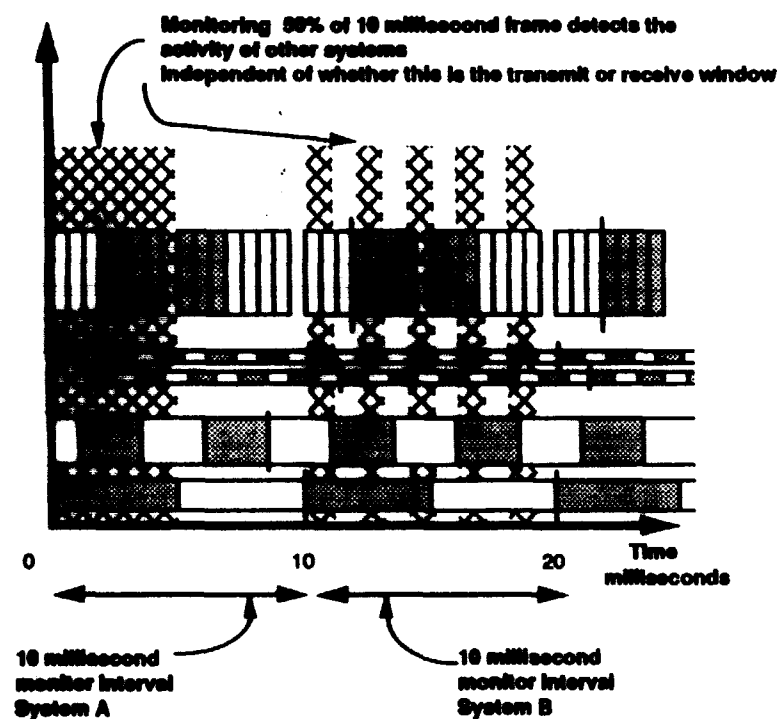
Due to the response time requirement in 15.321(c)(7), a transmission will be detected if it overlaps the monitor interval by $50\sqrt{1.25/BW}$ μ seconds. The monitor interval need not be aligned with the transmission interval for the activity to be detected.



Note that 10 ppm timing margin will allow the time slots of independent devices to drift with respect to each other at a rate of about 1 millisecond per minute so that a transmit window may drift to a receive window in a few minutes (seconds). Similarly, the 10 ppm frequency tolerance may allow collision in frequency although somewhat more slowly. Systems (devices) are expected to perform hand over to a new time/frequency window to correct for this drift.

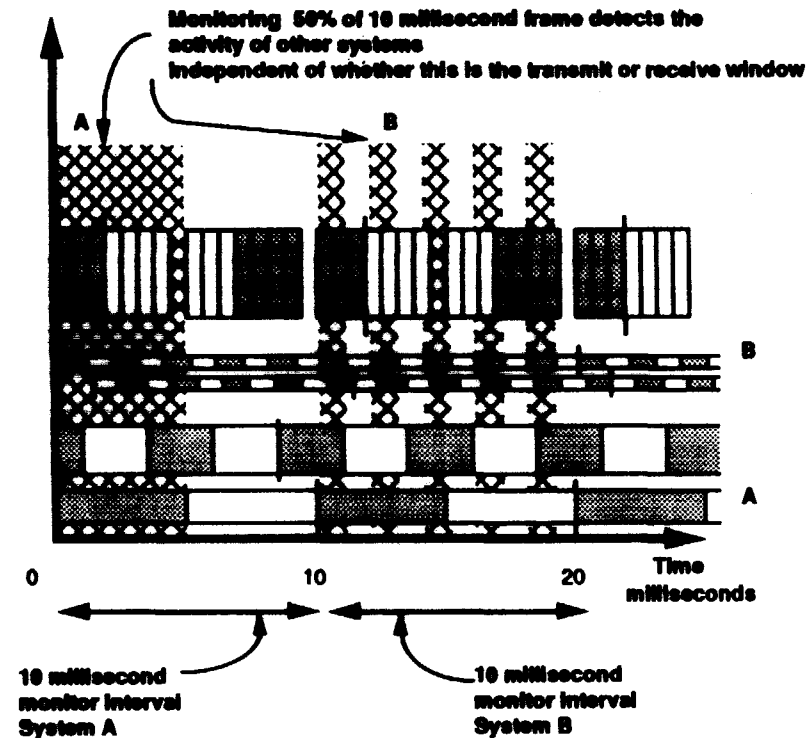
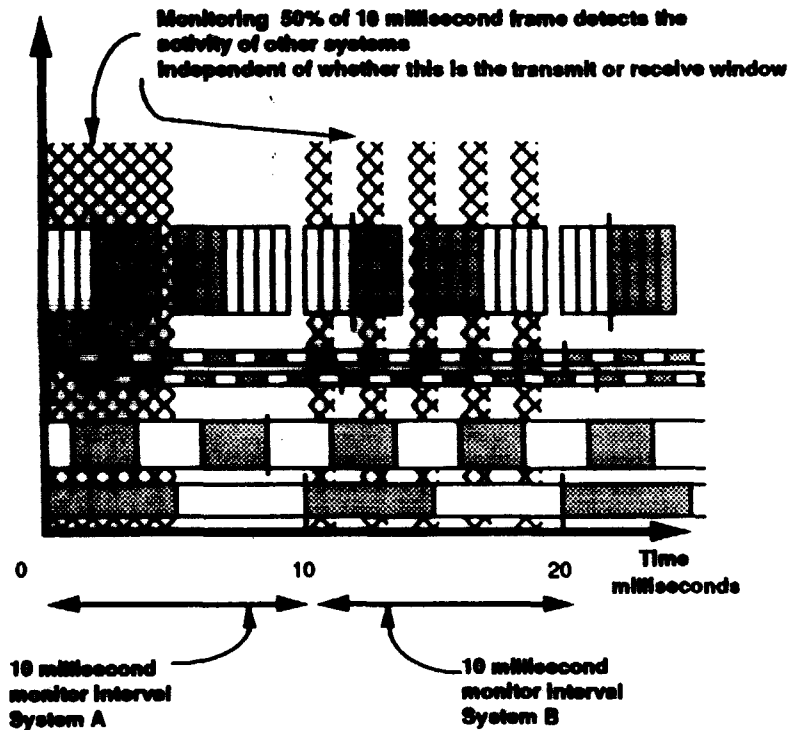
Monitoring Tx/Rx

Isochronous Sub-band
Comments



Monitoring during either Tx or Rx intervals can detect other system's activity

Monitoring Drift



Due to drift of frame timing between independent systems, monitoring interval of one system will overlap different parts of other systems' frames at different times.

suggested multi carrier access provision

15.321 (c)(11) Before initiating transmission, devices which are prevented from monitoring during their intended transmit interval due to receiver blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of a least 10 milliseconds to determine if the access criteria are met ~~so long as the monitored spectrum is within the 1.25 MHz frequency channel(s) already occupied by that device or co-located (within one metre) co-operating group of devices.~~ The receive monitoring interval must total a least 45% of the 10 millisecond interval.

Recommend removing the limitation to the same frequency channel proposed by WINTech in order to accommodate Wireless PBX air interface standard being proposed in TR41. Note that 15.321(c)(5) limits any device to no more than three 1.25 MHz frequency channels at once.

a

Duplex Operation

transmission on one time slot from base station implies a particular reciprocal slot from the portable

packing rule and lowest monitored channel rule may prevent the selection of the reciprocal pair at base and portable

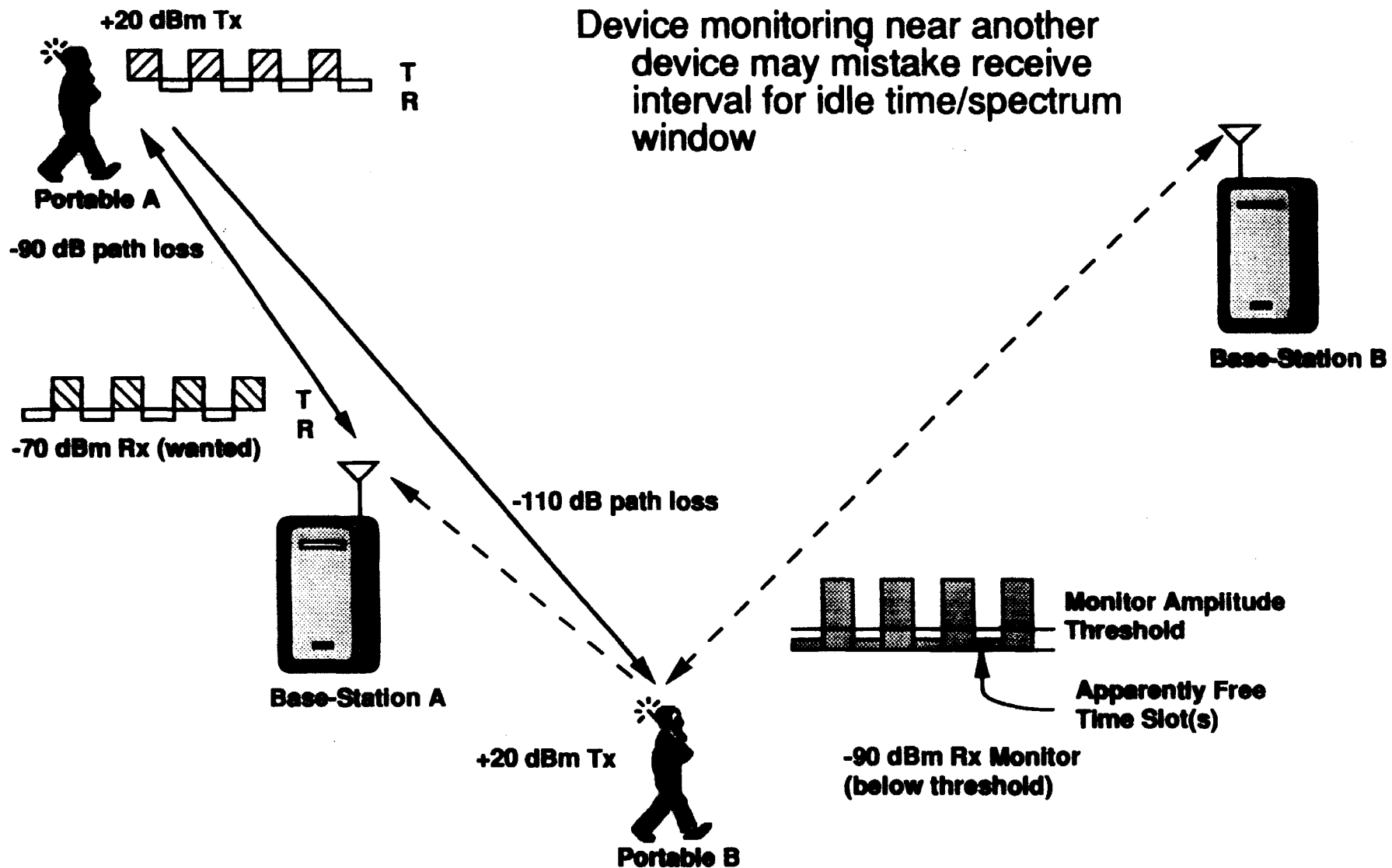
- WINTech provision for this situation :

15.321 (c)(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows in accordance with 15.321 (c). Time and spectrum window access selection for the initiating device shall be based on the higher measured power of the intended transmit or receive time and spectrum windows. If the power detected by the responding device can be decoded as a duplex connection signal from an interoperable device (the initiating device), then the responding device may immediately begin transmitting on the receive time and spectrum window of the initiating device.

under this rule, a responding device would be allowed to use a reciprocal time/spectrum slot if the initiating device had monitored both transmit and receive time/spectrum windows and found them to be free

Monitoring - Near/Far Condition

Isochronous Sub-band
Comments



(1) Channel Access and Operation

- (a) operation of multi-carrier devices**
- (b) duplex channels**



(2) Physical Limits

- (a) acknowledgement time limits**
- (b) channel packing in frequency and time**
- (c) protection of unlicensed operation from licensed emissions**
- (d) temperature range**

- SRO

15.321 (c)(4) Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease.

- The 1 second limit is inconsistent with normal call administration, set-up, paging, channel scanning and hand over times. For example to achieve satisfactory battery life in portables some designs "sleep" for a period of more than a second and thus must be "paged" for long enough (more than one second) to be sure they will wake up to receive a call. Also, for example, in order to account for interference or hand over a device may remain active on a channel for a second or so after loss of contact in order to avoid unnecessarily lost calls. The UTAM requirement for coordination with existing part 94 systems may necessitate the use of one way signalling (marker) transmissions to designate areas of service.

- WINTech recommendation was that these control and signalling functions be allowed for up to 30 seconds without acknowledgement.

* suggest changing the time limit to 30 seconds

revise to 15.321 (c)(4) to the following :

15.321 (c)(4) Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease unless the transmission is strictly for the transmission of control and signalling information in which case the limit is 30 seconds.

- SRO

15.321 (b) Intentional radiators with an intended emission bandwidth less than 625 kHz shall start searching for an available time and spectrum window at 1890 or 1920 MHz and search upward from that point. Devices with an intended emission bandwidth greater than 625 kHz shall start searching for an available time and spectrum window at 1930 or 1900 MHz and search downward from that point.

- The packing rule is impractical :

it may force devices to search through parts of the band where interference is high (due to other users of the band or nearby bands) and to be forced to communicate over unsatisfactory channels

by forcing devices to use the band edges it will cause the most interference to devices operating in nearby bands

in the event that several nearby devices are searching for a channel at the same time, there will be serious collisions as the devices select the same idle channels in the same order. They will be locked in an embrace of selecting and failing on the same set of channels

by confining devices to the band edges, the principles of cellular frequency partitioning and frequency re-use are excluded. These are key technologies to high efficiency multi-celled communications systems

* suggest deleting paragraph 15.321 (b)

Channel Packing (time)

Isochronous Sub-band
Comments

- SRO

15.321 (e) Transmission shall be continuous during the frame period defined for the device.

- This apparently allows only a single transmission interval during a frame. This would preclude operation of multi time slot TDMA devices such as base stations.

* Suggest deleting last sentence of paragraph 15.321 (e)

Protection from Licensed Emissions

Isosynchronous Sub-band
Comments

99.231 (a) Base stations are limited to 100 watts (e.i.r.p.) peak power with antenna height up to 300 metres HAAT.

(b) Mobile/portable stations are limited to 2 watts e.i.r.p peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

99.234 (a) On any frequency outside all PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 plus $10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation.

- The SRO rules could allow licensed PCS devices to emit at their full power within all of the PCS spectrum. This would include unlicensed PCS spectrum and allow 100 watt base station and 2 watt mobile emissions within the unlicensed band. This will result in intolerable levels of interference to the unlicensed devices. Suggest that the licensed devices be confined within the band they are licensed for operation, and that outside the licensed PCS bands the emissions be additionally constrained. Without the additional constraint, there will be significant interference from licensed to unlicensed services unless there is significant geographic separation.

* Suggest 99.234 be changed to read as follows :

99.234 (a) On any frequency outside the range of the licensed PCS bands, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 plus $10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation. Also, on any frequency outside the licensed PCS bands separated by more than 1.25 MHz from the edge of the licensed band, the emissions shall be below -30 dBm in a 100 kHz measurement bandwidth.

- SRO

15.321(f) The frequency stability of the carrier frequency of the intentional radiator shall be maintained within ± 10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -30 to $+50$ degrees C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 C. For equipment that is only capable of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

- This temperature range is a very severe requirement for low power equipment intended primarily intended for indoor operation. Will result in very expensive frequency control equipment and consequently short battery life in portable devices.

* Suggest reducing the range of temperature to -10 to $+40$ C and the range of supply voltage to 90 to 110%.